

Some Zoosporic Fungi of New Zealand. XIII. Traustochytriaceae, Saprolegniaceae and Puthiaceae

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In two previous publications on the biflagellate zoosporic fungi, the author (1967 a, 1967 b) discussed the species of the Plasmodiophoraceae, Olpidiopsidaceae, Siropidiaceae and Lagenidiaceae which were identified as parasites of higher plants, fungi and algae and as saprophytes in the soils of New Zealand. The present contribution concerns some species of the Traustochytriaceae, Saprolegniaceae and Pythiaceae. So far as the author is aware there are no published records of species of the Saprolegniaceae in New Zealand, but in two forthcoming papers Mrs. Elliott is reporting the occurrence of and morphological variations exhibited by *Achlya caroliniana* Coker, *A. flagellata* Coker, *Saprolegnia terrestris* Cookson and *S. australis* sp. nov. Species of the Saprolegniaceae were found by the author to be fairly common in water and soil, and many of the baited samples yielded several species. In addition to those identified below many others developed on substrata such as house flies, bits of corn leaves and hemp seeds, but these did not develop oogonia, antheridia and oospores. Therefore, it was impossible to identify them accurately. Accordingly, only a few species are listed here, and it is quite probable that with more intensive study many more species will be found in New Zealand. Species of *Pythium*, also, are very abundant in the soils, and they developed so vigorously on the various substrata that they became a nuisance in the study of other zoosporic fungi. As in the case of the saprolegniaceous species, only a few of them could be identified in the limited time available. As noted previously by the author (1965) most of the species became heavily infected by *Rozella* parasites. Species of the Albuginaceae and Peronosporaceae, parasitic on economic crop plants and "weeds", are well known in New Zealand and need not be considered in this series of papers on the zoosporic fungi of New Zealand.

Traustochytrium proliferum Sparrow, 1936. Biol. Bull. 70: 259, figs. 22—28, pl. 7, fig. 2.

Saprophytic (?) on *Bryopsis plumosa* and *Cladophora* sp. at the University of Otago Marine Biology Station, Portobello, Dunedin.

This species was very abundant on the two hosts named above, and continued to multiply for 2 weeks after the hosts and sea water were brought into the laboratory. The sizes of the proliferating sporangia, rhizoids, and zoospores and the variations which they exhibited conformed fairly closely to those reported from the States and elsewhere.

Schizochytrium aggregatum Goldstein and Belsky, 1964.
Amer. J. Bot. 51: 72, figs. 1—16.

Saprophytic on algal debris and pollen grains of *Phyllocladus trichomanoides* at the University of Otago Marine Biology Station, Portobello, Dunedin.

This peculiar species which proliferates sporangia by successive bipartitioning of the thallus occurred in great abundance when algal debris and sea water were brought into the laboratory and baited with pollen grains. Its occurrence in marine waters of New Zealand is of special interest because it has been reported only once previously from Connecticut and New York, U.S.A. Now that its appearance and development are known, it will probably be found to be widely distributed in marine waters. The shapes and sizes of the thalli, sporangia and zoospores, and the sequence of developmental stages in the New Zealand specimens were similar to those described by Goldstein and Belsky, and at present there seems to be no reason for regarding them as relating to a different species. Goldstein and Belsky classified this fungus as a member of the Traustochytriaceae, but the successive bipartitioning of the thallus to form sporangia is unique, so far as is known. On this basis it might better be made the type of a new family for which the name Schizochytriaceae is proposed.

Sommerstorffia spinosa Arnaudow, 1923. Flora 116: 109, 5 figs.

Attached to bits of snake skin and predaceous on rotifers in soil samples AMA and AKT.

This unusual, stiff-looking fungus with tapering predaceous pegs appears to be more widely distributed than was formerly believed, and this reports of its presence in New Zealand adds another country to the growing list of localities in which it occurs. So far it has been reported in Bulgaria (Arnaudow, 1923), Massachusetts (Sparrow, 1929), New Jersey, Virginia, Louisiana and Alaska, U.S.A. (Karling, 1952), England (Prowse, 1954), and India (Karling, 1966). No oogonia and antheridia were found in the New Zealand material, but the thalli, zoospores and sporelings were similar to those described by the author (1952) for the Alaskan specimens.

Pythiopsis cymosa de Bary, 1888. Bot. Zeit. 46: 63, pl. 9, fig. 1.

Saprophytic in decaying vegetable debris from the Hutt River near the water wier, Wellington, Province.

Saprolegnia ferox (Gruith.) Thuret, 1850. Ann. Sci. Nat. Bot. ser. 3, 14: 229, pl. 22.

Achlya prolifera Pringsheim, 1851. Nova Acta Acad. Leop. Carol. 23: 395, pls. 64—50.

Saprolegnia dioica Pringsheim, 1860. Jahrb. Wiss. Bot. 2: 206, pl. 22, figs. 1—6.

Saprolegnia dioica var. *racemosa* de la Rue, 1869. Bull. Soc. Imp. Nat. Moscow 421: 469 (See Fischer, 1892, p. 336).

Saprolegnia thureti de Bary, 1881. Abhandl. Senckenb. Nat. Gesell. 12: 326, pl. 5; figs. 1—10.

Saprolegnia bodanica Maurizio, 1896. Jahrb. Wiss. Bot. 29: 107, pl. 2, Figs. 52—59 a.

Saprophytic on house flies in a tub of rainwater at the Botany Dept., University of Otago, Dunedin.

Saprolegnia litoralis Coker, 1923. Saprolegniaceae, p. 54, pls. 15, 16.

Saprophytic on insect exuviae and bits of hemp seed in water from a swampy brook on the Kaitoke Farm, Wellington Province.

Brevilegnia longicaulis Johnson, 1950. Mycologia 42: 244, figs. 1 a—1 q.

Saprophytic on bits of hemp seed from soil sample AW RKF.

The isolate of this fungus resembled Johnson's species from New Caledonia quite closely and it is, accordingly, identified as such.

Aphanomyces stellatus de Bary, 1860. Jahrb. wiss. Bot. 2: 178, pl. 19, figs. 1—13.

Aphanomyces coniger Petersen, 1910. Ann. Mycol. 8: 525, figs. J—L.

Saprophytic on bits of snake skin and insect exuviae in soil samples AKT, HBHW and OHT.

Aphanomyces laevis de Bary, 1860. Jahrb. Wiss. Bot. 2: 179, pl. 20, figs. 17, 18.

Aphanomyces balboensis Harvey, 1942. J. Elisha Mitchell Sci. Soc. 58: 35, pl. 8, figs. 1—7.

Saprophytic on bits of snake skin and insect exuviae in soil samples ATRC, WKI-WK 4, WT4, OD2, ODC, OKF and NTF.

Aphanomyces phycophilus de Bary, 1860. Jahrb. Wiss. Bot. 2: 179, pl. 20, figs. 19—24.

Parasitic in *Spirogyra* sp. in a pond at the Soil Bureau, Taita, Wellington Province.

Leptolegnia caudata de Bary, 1888. Bot. Zeit. 46: 609, pl. 9.

Saprophytic on insect exuviae and bits of snake skin in soil sample ATFP.

Leptolegniella keratinophila Huneycutt, 1952. J. Elisha Mitchell Sci. Soc. 68: 109, pl. 15.

Saprophytic in bits of snake skin in soil samples ATFP, OD4, OKF and NTF.

This species is fairly common in New Zealand and developed abundantly in bits of snake skin floated on watered soil samples.

Leptolegniella exospora Kane, 1966. Mycologia 58: 909, figs. 1—24.

Saprophytic in human hair from soil samples AKT, and WK3.

This recently described species occurred abundantly in the two soil samples noted above, and it appears to be widely distributed in European and African soils according to Miss Kane, who found it in Indiana, U.S.A., soil. In checking back on his notes and illustrations the author found that he had recorded but not identified it in human hair in soil samples from Tippecanoe County, Indiana, while he was studying keratinophilic chytrids in 1946 to 1948.

Achlya prolifera Nees, 1823. Nova Acta Acad. Leop.-Carol. 11: 514, pl. 58.

Leptomitius prolifer Agardh, 1824. Systema algarum. 1: 48.

Saprolegnia prolifera Braun, 1851. Betrachtungen über die Erscheinung der Verjüngung in der Natur, p. 268.

Achlya aplanes Maurizio, 1894. Flora 79: 135, pls. 4, 5, figs. 28—31.

Saprophytic in bleached corn leaves, dead flies, and bits of hemp seeds in soil samples ADSIR, WT2, OD4, OKF, and water from a pond at the Soil Bureau, Taita, Wellington Province.

Achlya treleaseana (Humphrey) Kauffman, 1906. Ann. Rept. Mich. Acad. Sci., Arts and Letters 8: 26.

Saprolegnia treleaseana Humphrey, 1893. Trans. Amer. Phil. Soc. (n. s.) 17, 111, pl. 17, figs. 56—59.

Saprophytic on bits of hemp seed in water from a small brook at Cornwallis Wharf, Auckland Province.

Achlya hypogyna Coker and Pemberton, 1908. Bot. Gaz. 45: 194, figs. 1—6.

Saprophytic on bits of hemp seed in a pond in the Eglington Valley, Otago Province.

Achlya flagellata Coker, 1923. Saprolegniaceae p. 116, pl. 37.

Saprophytic on dead flies and bits of hemp seed in water from the Hutt River near Taita, Wellington Province.

Achlya klebsiana Pieters, 1915. Bot. Gaz. 60: 486, pl. 21, figs. 1—4.

Achlya oryzae Ito and Nagai, 1931, in Nagai J. Fac. Agric. Hokkaido Imp. Univ. 32: 17, pl. 4, figs. 3—11.

Achlya klebsiana var. *indica* Chaudhuri and Lotus, 1936. Proc. Indian Acad. Sci., Sect. B, 3: 328, pl. 2.

Achlya michiganensis Johnson, 1950. Mycologia 42: 393, fig. 2.
Saprophytic on bits of hemp seed in soil sample OD4.

Isoachlya unisporea Coker and Couch, 1923. Saprolegniaceae, p. 85, pls. 22, 23.

Saprophytic on house fly in a pond at the Soil Bureau, Taita, Wellington Province.

Dictyuchus monosporus Leitgeb, 1869. Jahrb. Wiss. Bot. 7: 357, pl. 22, figs. 1—12, pl. 23, figs. 1—8.

Saprophytic on house flies from soil sample HBTF.

Thraustotheca clavata (de Bary) Humphrey 1893. Trans. Amer. Phil. Soc. 17: 131.

Dictyuchus clavatus de Bary, 1888. Bot. Zeit. 46: 649, pl. 9, fig. 3.

Saprophytic on bits of hemp seed in a cold pool, Gibb's Bache, Belmont, Wellington.

Zoophagus insidiarius Sommerstorff, 1911. Österr. Bot. Zeitschr. 61: 372, pls. 5, 6.

Growing among algae in ponds at the Soil Bureau, Taita, Wellington Province; Eglinton Valley, and swampy soil sample HBTF2, Otago Province, and predaceous on rotifers.

Pythium monospermum Pringsheim, 1858. Jahrb. Wiss. Bot. 1: 284—306.

Pythium gracile de Bary, 1860. Jahrb. Wiss. Bot. 2: 169—192.

Pythium reptans de Bary, l. c., p. 169.

Pythium fecundum Wahrlich, 1887. Ber. deut. Bot. Gesell. 5: 246, pl. 10.

Pythium complens Fischer, 1892. Rabenhorst Kryptogamen-Fl. 1, (4): 398, fig. 64 a—b.

Saprophytic in bleached corn leaves in soil sample AKT.

Pythium gracile Schenk, 1859. Verhandl. Phys. Med. Gesell. Würzburg 9: 12, pl. 1, figs. 1—6.

Parasitic in *Spirogyra* sp. and *Vaucheria* sp. in a pond at the Soil Bureau, Taita, Wellington Province.

Pythium tenue Gobi, 1899—1900. Scrip. Bot. Hort. Imp. Petropol. 15: 211, pls. 415.

Parasitic in *Vaucheria sessilis* in a small stream at the Soil Bureau, Taita, Wellington Province.

Pythium torulosum Coker and Patterson, 1927. J. Elisha Mitchell Sci. Soc. 42: 247—250, pl. 46.

In decaying *Marchantia* thalli in a swampy area at the Soil Bureau, Taita, Wellington Province.

Pythium graminicolum Subramaniam, 1928. Bull. Agric. Res. Inst. Pusa 177: 1—7, fig. 1.

Parasitic (?) in decaying roots of rye grass in soil sample HBT.

Pythium inflatum Matthews, 1931. Studies on the genus *Pythium*, p. 45, pl. 9.

Saprophytic in bleached corn leaves from soil sample WK3.

Pythium proliferum de Bary, 1860. Jahrb. Wiss. Bot. 2: 169, pl. 21.

Saprophytic on insect exuviae in a pond at the Soil Bureau, Taita, Wellington Province.

Pythium debaryanum Hesse, 1874. Inaugr. Dissert. Halle.

Pythium equiseti Sadebeck, 1874. Verhandl. Bot. Ver. Prov. Brandenburg, 16: 116—124.

Lucidium pythioides Lhode, 1874. Tagebl. Versamm. Deut. Naturf. Aerzte, Breslau 47: 203.

Pythium autumnale Sadebeck, 1876. Tagebl. Versamm. Deut. Naturf. Aerzte, Breslau 49: 100.

Artotrogus debaryanus Atkinson, 1895. Cornell Agric. Exp. Sta. Bull. 94: 233—275, figs. 1—9.

Pythium haplomitrii Lilienfeld, 1911. Bull. Intern. Acad. Sci. Cracovie 1911: 336.

Pythium debaryanum var. *pelargonii* Braun, 1925. J. Agric. Res. 30: 1060, pl. 7.

Pythium marchantiae Nicholas, 1926. Compt. Rend. Acad. Sci. 182: 82—83.

Pythium fabae Cheney, 1932. Austral. J. Exp. Biol. Med. Sci. 10: 143—155.

Pythium ariosporon Sideris, 1932. Mycologia 24: 14—61, figs. 1 a, 8 c—d.

Pythium cactacearum Preti, 1936. Rev. Path. Veg. 26: 331—353.

Parasitic on seedling roots of *Brassica oleracea* var. *capitata*, Lincoln, Canterbury Province.

Pythium spinosum Sawada, 1926. Jour. Nat. Hist. Soc. Formosa 16: 199.

Parasitic (?) on seedling roots *Lactuca sativa*, Soil Bureau, Taita, Wellington Province.

Pythium irregulare Buisman, 1927. Med. Phytopath. 11: 1, figs. 9—11.

Saprophytic on bleached corn leaves in soil sample AKT.

Summary

Thirty-two species of the Traustochytriaceae, Saprolegniaceae and Pythiaceae are identified as saprophytes and parasites in the soil and algae in New Zealand. Among these is the unusual species, *Schizochytrium aggregatum*, which develops sporangia by successive bipartitioning of the thallus. This type of development is unique for the zoosporic fungi, so far as is known, and for this reason a new family, Schizochytriaceae, is proposed to include it and other similar species which may be found in the future.

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